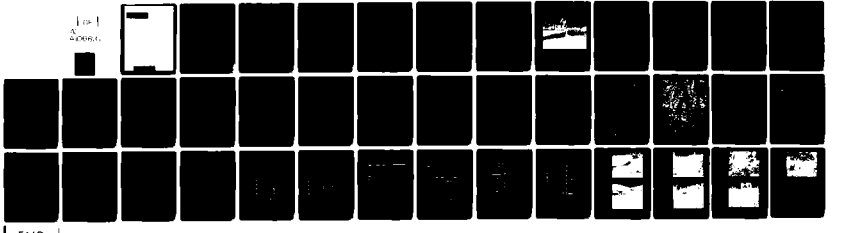
AD-A106 631 ARMY ENGINEER DISTRICT ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. SWEETWATER DAM (NONAME 251) (MO 30--ETC(U)
DEC 78 A L JOHNSON

UNCLASSIFIED NL



END
DATE FILMED
11-81
DTIC

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|---|
| 1. REPORT NUMBER | 2. GOVT ACCESSION NO. AD-A106634 / 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Sweetwater Dam - Noname 251 (MO 30436) Jefferson County, Missouri | 5. TYPE OF REPORT & PERIOD COVERED Final Report / 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s) Corps of Engineers, St. Louis District | 8. CONTRACT OR GRANT NUMBER(s) N/A |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101 | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 12 14 |
| 11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101 | 12. REPORT DATE December 1978 / 13. NUMBER OF PAGES Approximately 30 |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) | 15. SECURITY CLASS. (of this report) UNCLASSIFIED / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |
| 16. DISTRIB National Dam Safety Program. Sweetwater Dam (No Name 251) (MO 30436), Mississippi - Kaskaskia - St. Louis Basin, Jefferson County, Missouri. Phase I Inspection Report. Approved for release; distribution unlimited. | |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) | |
| 18. SUPPLEMENTARY NOTES | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property. | |

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

## INSTRUCTIONS FOR PREPARATION OF REPORT DOCUMENTATION PAGE

RESPONSIBILITY. The controlling DoD office will be responsible for completion of the Report Documentation Page, DD Form 1473, in all technical reports prepared by or for DoD organizations.

CLASSIFICATION. Since this Report Documentation Page, DD Form 1473, is used in preparing announcements, bibliographies, and data banks, it should be unclassified if possible. If a classification is required, identify the classified items on the page by the appropriate symbol.

### COMPLETION GUIDE

Blc [redacted] General. Make Blocks 1, 4, 5, 6, 7, 11, 13, 15, and 16 agree with the corresponding information on the report cover. Leave 2 and 3 blank.

Block 1. Report Number. Enter the unique alphanumeric report number shown on the cover.

Block 2. Government Accession No. Leave Blank. This space is for use by the Defense Documentation Center.

Block 3. Recipient's Catalog Number. Leave blank. This space is for the use of the report recipient to assist in future retrieval of the document.

Block 4. Title and Subtitle. Enter the title in all capital letters exactly as it appears on the publication. Titles should be unclassified whenever possible. Write out the English equivalent for Greek letters and mathematical symbols in the title *(see "Abstracting Scientific and Technical Reports of Defense-sponsored RDT/E," AD-667 000)*. If the report has a subtitle, this subtitle should follow the main title, be separated by a comma or semicolon if appropriate, and be initially capitalized. If a publication has a title in a foreign language, translate the title into English and follow the English translation with the title in the original language. Make every effort to simplify the title before publication.

Block 5. Type of Report and Period Covered. Indicate here whether report is interim, final, etc., and, if applicable, inclusive dates of period covered, such as the life of a contract covered in a final contractor report.

Block 6. Performing Organization Report Number. Only numbers other than the official report number shown in Block 1, such as series numbers for in-house reports or a contractor/grantee number assigned by him, will be placed in this space. If no such numbers are used, leave this space blank.

Block 7. Author(s). Include corresponding information from the report cover. Give the name(s) of the author(s) in conventional order *(for example, John R. Doe or, if author prefers, J. Robert Doe)*. In addition, list the affiliation of an author if it differs from that of the performing organization.

Block 8. Contract or Grant Number(s). For a contractor or grantee report, enter the complete contract or grant number(s) under which the work reported was accomplished. Leave blank in in-house reports.

Block 9. Performing Organization Name and Address. For in-house reports enter the name and address, including office symbol, of [redacted] performing activity. For contractor or grantee reports enter the name and address of the contractor or grantee who prepared the rep [redacted] and identify the appropriate corporate division, school, laboratory, etc., of the author. List city, state, and ZIP Code.

Block 10. Program Element, Project, Task Area, and Work Unit Numbers. Enter here the number code from the applicable Department of Defense form, such as the DD Form 1498, "Research and Technology Work Unit Summary" or the DD Form 1634. "Research and Development Planning Summary," which identifies the program element, project, task area, and work unit or equivalent under which the work was authorized.

Block 11. Controlling Office Name and Address. Enter the full, official name and address, including office symbol, of the controlling office. *(Equates to funding/sponsoring agency. For definition see DoD Directive 5200.20, "Distribution Statements on Technical Documents.")*

Block 12. Report Date. Enter here the day, month, and year or month and year as shown on the cover.

Block 13. Number of Pages. Enter the total number of pages.

Block 14. Monitoring Agency Name and Address *(if different from Controlling Office)*. For use when the controlling or funding office does not directly administer a project, contract, or grant, but delegates the administrative responsibility to another organization.

Blocks 15 & 15a. Security Classification of the Report: Declassification/Downgrading Schedule of the Report. Enter in 15 the highest classification of the report. If appropriate, enter in 15a the declassification/downgrading schedule of the report, using the abbreviations for declassification/downgrading schedules listed in paragraph 4-207 of DoD 5200.1-R.

Block 16. Distribution Statement of the Report. Insert here the applicable distribution statement of the report from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

Block 17. Distribution Statement *(of the abstract entered in Block 20, if different from the distribution statement of the report)*. Insert here the applicable distribution statement of the abstract from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

[redacted] Block 18. Supplementary Notes. Enter information not included elsewhere but useful, such as: Prepared in cooperation with Translation of *(or by)* . . . Presented at *conference* of . . . To be published in . . .

Block 19. Key Words. Select terms or short phrases that identify the principal subjects covered in the report, and are sufficiently specific and precise to be used as index entries for cataloging, conforming to standard terminology. The DoD "Thesaurus of [redacted] ineering and Scientific Terms" *(TEST)*, AD-672 000, can be helpful.

Block 20. Abstract. The abstract should be a brief *(not to exceed 200 words)* factual summary of the most significant information contained in the report. If possible, the abstract of a classified report should be unclassified and the abstract to an unclassified report should consist of publicly- releasable information. If the report contains a significant bibliography or literature survey, mention it here. For information on preparing abstracts see "Abstracting Scientific and Technical Reports of Defense-Sponsored RDT&E," AD-667 000.

☆ U.S. G.P.O. 1980-665-141/1299

LOWER MISSISSIPPI RIVER BASIN

# SWEETWATER DAM (NO NAME 251)
# JEFFERSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30436

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED BY: ST. LOUIS DISTRICT CORPS OF ENGINEERS
FOR: GOVERNOR OF MISSOURI

DECEMBER 1978

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

NAME: Sweetwater Dam (No Name 251)

LOCATION: Jefferson County, Missouri

STREAM: Unnamed Tributary of Dulin Creek

DATE OF INSPECTION: 15 December 1978

Sweetwater Dam, Mo. 30436 (No Name 251), was inspected using the "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed by the Chief of Engineers, U.S. Army, Washington D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The downstream damage zone is approximately one-half mile long. Three buildings, including one home, and one improved road crossing are located within the damage zone. They would be subjected to flooding with possible damage and/or destruction and possible loss of life if the dam should suddenly fail. The dam is in the small size classification because it is less than 40 feet high and impounds less than 1000 acre-feet of water.

For its size and hazard category, this dam is required by the guidelines to pass one-half PMF to the PMF. The PMF is defined as resulting from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. Considering the short damage zone and the limited amount of development downstream of the dam, one half the PMF is considered the appropriate spillway design flood. The spillway of this dam will pass only 20 percent of the PMF without overtopping the dam. Our evaluation indicates that the spillway will pass the 100-year flood, that is a flood having a 1 percent chance of exceedence in any given year, without the dam being overtopped. Since the spillway for Sweetwater Dam is not capable of passing a minimum of one-half (50 percent) of the PMF without overtopping the dam, the spillway is considered inadequate.

The inspection team observed heavy tree growth covering the downstream slope of the dam and spillways. Some trees were 6 to 10 inches in diameter. The root systems of these trees are a potential

seepage hazard and constitute a maintenance deficiency. Potential exists for other deficiencies such as rodent holes to be found after the trees and brush have been removed.

The downstream slope of the dam was eroded considerably in the area of the right abutment where flow from the right spillway has occurred in the past. A large scour hole has developed immediately downstream of the crest of the right spillway. A ditch has been eroded along the toe of the embankment from the scour hole to the old streambed downstream of the dam. The scour hole and eroded ditch constitute a maintenance deficiency that should be repaired. Corrective measures should be taken to prevent reoccurrence of scour and erosion in this area.

Seepage and stability analyses are not on record as recommended in the guidelines, which is considered a deficiency that should be rectified.

It is recommended that action be taken by the owner to implement the remedial measures listed herein in the near future. Any corrective works performed in relation to increasing the spillway size and/or dam height and stability, and seepage investigations of the embankment should be made in accordance with analyses and design performed by an engineer experienced in the design of dams. These conclusions were reached by the undersigned *inspection team members.*

Robert C. MacDonald
ROBERT MacDONALD
Soils Engineer

Ronald J. Dieckmann
RONALD J. DIECKMANN
Hydraulic Engineer

SUBMITTED BY: William L. Johnson for Chief, Engineering Division — 28 Dec 78 Date

APPROVED BY: Leon E. Mathy Colonel, CE, District Engineer — 28 Dec '78 Date

OVERVIEW OF SWEETWATER DAM (NO NAME 251)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SWEETWATER DAM (NO NAME 251)

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF PLATES



APPENDIX



PHOTOGRAPHS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SWEETWATER DAM (NO NAME 251) ID NO. 30436

## SECTION 1 - PROJECT INFORMATION

### 1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Sweetwater Dam (No Name 251) be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. The inspection was accomplished using the "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed by the Chief of Engineers, U. S. Army, Washington, D. C., with the help of several Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

### 1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure built in a small valley in the north-east portion of the Missouri Ozark Region. Topography adjacent to the lake is rolling. Topography in the vicinity of the dam is shown on PLATE 2.

(2) The dam has two non-regulated spillways. One spillway is located at the left abutment and the other near the right abutment (see photographs 2 and 4). The left spillway is lower, by less than one foot, than the right spillway. The exit channel of the right spillway is adjacent to the toe of the dam embankment. The exit channel of the left spillway is separated from the toe of the embankment.

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the north-west portion of Jefferson County, Missouri, just south of House Springs, Missouri. The lake formed by the dam is shown on the 1974 revised Belew Creek, Missouri USGS Quadrangle Sheet in the northeast quarter of Section 20, Township 42N, Range 4E (see PLATES 1 and 2).

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in Volume 1, Appendix D, Chapter 5, of the National Program of Inspection of Dams Report. Based on these criteria, this dam and impoundment is in the small size classification.

d. Hazard Classification. Criteria for determining hazard classification are presented in the same report as referenced in paragraph c above. Based on referenced criteria, this dam is in the High Hazard Classification. A high hazard dam is one which poses hazards to human life or which would cause extensive property damage should the dam suddenly fail. Three buildings, including one home, and one improved road crossing are located within one half mile of the dam. They would be subjected to potential damage and/or destruction, and loss of life could result if this dam should suddenly fail. A sudden failure of this dam may cause damage within a downstream damage zone which is approximately one half mile long.

e. Ownership. This dam is owned by Charles T. Telle, Route 2, Box 453, High Ridge, Missouri 63049.

f. Purpose of Dam. The dam forms a 6-acre recreation lake.

g. Design and Construction History. No design and construction history was available from the present owner who acquired the dam about 2 months prior to the inspection. The previous owner was contacted but no information could be obtained. A member of his family reported that the dam was built about 19 years ago.

h. Normal Operating Procedure. There are no spillway or outlet structures which can be manually controlled.

1.3 PERTINENT DATA

a. Drainage Area - 80 Acres

b. Discharge at Damsite - Unknown - The spillways are the only outlet from the dam. Evidence of spillway flow in the past is visible at both spillways (see photographs 3 and 5). There is no visible evidence of overtopping of the dam. No discharge information is available from the owner.

c. Elevation (feet above MSL)

(1) Top of dam - 689 ±

(2) Spillway Crest - Left Spillway 687 ±
Right Spillway 687.5 ±

(3) Streambed at toe of dam - 660 ±

(4) Maximum tailwater - Unknown

d. Reservoir:

(1) Length of maximum pool - approximately 1100 ± feet.

(2) Length of recreation pool - approximately 1000 ± feet.

e. Reservoir Surface (acres):

(1) Top of dam - 8.0 (reported by owner)
7.2 (topographic quadrangle map)

(2) Spillway crest - 6.2 (topographic quadrangle map)

f. Storage (Acre-feet)

(1) Top of dam - 85 (estimated from map)

(2) Spillway Crest - 74 (estimated from map)

g. Dam.

(1) Type - earth embankment

(2) Length - 360 ± feet

(3) Height - 29 ± feet maximum

(4) Top width - 24 ± feet

(5) Side slopes -

(a) Downstream - 1V on 2.4H (Average)

(b) Upstream - Unknown (Upstream Slope Underwater)

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

i. Spillway

| | Left | Right |
|---|---|---|
| (1) Type - | Uncontrolled (channel) | Uncontrolled |
| (2) Width of weir - | 24 ± feet | 30 ± feet |
| (3) Length of weir - | approx. 100 feet | approx. 40 feet |
| (4) Crest elevation - | 687 ± | 687.5 ± |

j. Regulating Outlets: None

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

No design drawings or calculations are available for this dam.

### 2.2 CONSTRUCTION

Construction was reported to have been completed 19 years ago. No construction records are available.

### 2.3 OPERATION

No operations because spillway is ungated.

### 2.4 EVALUATION

a. Availability. No data was available.

b. Adequacy. Data available were not adequate to make an engineering analysis of the dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed and made a matter of record.

c. Validity. No valid engineering design data or construction data were available.

## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

a. General. Sweetwater Dam (No Name 251) was visually inspected by a geologist, soils engineer, and a hydraulics engineer on 15 December 1978. The present owner met the inspection team. The previous owner was contacted on 15 December 1978 but no information could be obtained. Observations made by the inspection team are discussed below.

b. Geology. The Sweetwater Dam and drainage area is underlain by the Plattin formation of the Champlainian (middle) Series formed during the Ordovician Period (440-500 million years before present). The Ordovician and Kimmswick formations also outcrop on the steep upland slopes above the lake, and the ridgetops are capped by the Mississippian Fern Glen formation. The Plattin formation outcrops as a series of ledges in the spillway on the left abutment. This rock is light gray, thickly bedded, fine grained limestone, with a highly pitted surface. A ledge of massive, unpitted limestone outcrops at the upper part of the spillway.

The rock is essentially horizontal with a slight regional dip to the northeast and is crossed by a series of widely spaced, generally open (1-2 inches), near vertical joints trending approximately N20°E. The dam is located approximately 4 miles southwest of a fault associated with the Eureka-House Springs structure which has been described as being post-Mississippian (350 million years before present) and is not considered to be active. No evidence of caves or other karst features was observed on either abutment.

c. Dam. The crest of the dam is about 24 feet wide and the height is estimated at 29 feet (see PLATES 3 and 4). An embankment cross section is shown on PLATE 4. The slopes indicated are considered typical of the slopes on the entire embankment. The downstream slope of the dam and spillways are covered with trees and brush. (See photographs 1, 4 and 6.) The left spillway channel runs for about 100 feet downstream from the dam on a mild slope, then tapers off into the old streambed.

A large scour hole was observed in the downstream slope of the embankment in the spillway area at the right abutment as shown on photographs 2 and 3. The scour hole is about 4 feet by 20 feet, and approximately 8 feet deep at its maximum depth just downstream of the crest of the spillway. Moving in a downstream direction, the depth of the hole decreases, forming a ditch about one foot deep by

two feet wide that runs along the toe of the dam embankment to the old streambed. There were no other problems such as seeps, slides, cracks, or detrimental settlements observed on the dam embankment.

No riprap was observed anywhere on the upstream or downstream slopes of the dam or on the spillway. There was, however, no evidence of erosion of the dam embankment.

d. Reservoir Area. No wave wash, excessive erosion, or slides were observed along the shore line.

The appearance of the shoreline indicated that the lake level on the day of the inspection was the approximate normal level that the lake remains at, most of the time.

e. Spillway Seepage. A small trickle of water, estimated to be about two gallons per minute, was observed seeping from a bedding plane and an open vertical joint in the abutment rock that outcrops about halfway down the spillway in the left abutment, just downstream of the dam (see photograph 7). The water appeared to be clear and void of any fine materials; therefore, it can be assumed that embankment material is not being piped. The source of the seepage is uncertain. Considering the relatively low position with respect to the stream valley wall and the pool elevation, the seepage could be natural groundwater coming from the valley slopes or it could be a hydraulic connection with the pool through the abutment.

## 3.2 EVALUATION

The tree growth on the downstream slope of the dam is very extensive and poses a potential seepage problem. The scour hole in the downstream slope of the embankment in the spillway area at the right abutment is a potential source of seepage and sliding problems. If not repaired, it could result in flow from the pool and extensive erosion of embankment material. The seepage noted in the rock outcrop in the left spillway exit channel (see paragraph 3.1e) is not thought to pose any problem concerning the integrity of the dam.

The left spillway has extensive tree growth and a wire fence across it (see photograph 4). These items may catch leaves and debris, and block or impede spillway flows.

## SECTION 4 - OPERATIONAL PROCEDURES

### 4.1 PROCEDURES

There is no regulation of flow.

### 4.2 MAINTENANCE OF DAM

As shown on Photos 1 through 6, the downstream slope of the dam and the left spillway area has not been maintained as evidenced by the heavy brush and tree growth. Also, the scour hole and ditch downstream of the spillway at the right abutment has not been repaired (see paragraph 3.1c).

### 4.3 MAINTENANCE OF OPERATING FACILITIES

None

### 4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

No warning system is known to exist.

### 4.5 EVALUATION

Maintenance and Operation of existing facilities were inadequate at the time of this inspection.

## SECTION 5 - HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

a. Design Data. No design data were made available to the inspection team. The present owner bought the property about two months before the inspection, and he did not have any design data. The previous owner was contacted but no information could be obtained.

b. Experience Data. All of the pertinent data furnished in this report are based on computations derived from either a U.S. Geological Survey 7-1/2 minute quadrangle sheet (Belew Creek, Missouri) or measurements and surveys made during the field inspection.

c. Visual Observations. It appears that the lake regularly fills to about 1 to 2 feet above the water surface elevation of the lake observed on the day of the field inspection which was 686.0 ±. The spillway exit channel at the left of the dam is not well defined. This spillway channel runs for about 100 feet downstream from the dam on a mild slope then tapers off into the old streambed. The channel and channel entrance are not well maintained, being overgrown with thick vegetation and trees. The right spillway is a more defined swale-like section which is grass covered and mowed regularly along with the top of the dam. Discharge from the right spillway flows along the toe of the dam embankment toward the old streambed. A large scour hole and ditch have been eroded downstream of the spillway as described in paragraph 3.1c.

d. Overtopping Potential. For its size and hazard category, this dam should be able to pass one half PMF to the PMF without overtopping the dam. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. Considering the short damage zone and the limited amount of development downstream of the dam, one half the PMF is considered the appropriate spillway design flood. The spillway will pass approximately 20 percent of the PMF without overtopping of the dam. Also, our evaluation indicates the spillway will pass the 100-year flood without overtopping the dam; that is, a flood having a 1 percent chance of being equaled or exceeded during a given year. For the PMF and the one-half PMF, the dam would be overtopped 1.7 feet and 0.9 feet for 6.0 hours and 2.7 hours with a discharge of 1600 cfs and 800 cfs, respectively.

## SECTION 6 - STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of the dam and spillway are discussed and evaluated in Sections 3 and 5. The dam has no other appurtenant structures.

b. Design and Construction Data. No design or construction data are available.

c. Operating Records. No operating records are available.

d. Post Construction Changes. No information available.

e. Seismic Stability. Sweetwater Dam is in Seismic Zone 2, for which the recommended guidelines assign a "moderate" damage probability. The relatively low height and the type of material of which the dam was constructed minimize the likelihood of failure due to earthquake shock.

## SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

a. Safety. The spillway cannot pass one-half the Probable Maximum Flood without overtopping the dam. For its size and hazard category, this dam is required by the guidelines to pass from one-half PMF to the PMF. Considering the short damage reach and the limited amount of development downstream of the dam, one half the PMF is considered the appropriate spillway design flood. The spillway size and/or height of the dam should be increased to pass one-half the PMF without overtopping the dam. Overtopping of the dam could be detrimental to the structural integrity of the dam. The major deficiencies observed were vegetation on the left spillway and downstream slope of the dam and spillways, the scouring and erosion of the dam embankment downstream of the spillway at the right abutment, and the lack of sufficient spillway capacity needed to pass one-half the PMF without overtopping the dam. Since the spillways for Sweetwater Dam are not capable of passing a minimum of one-half (50 percent) of the PMF without overtopping the dam, the spillway is considered inadequate.

b. Adequacy of Information. Due to the lack of engineering design and construction data, the conclusions in this report were based only on visual observations. Guidelines furnished for inspection of dams require that seepage and stability analyses be on file for each dam inspected. No such data are available for this dam. This is considered a deficiency which should be corrected.

c. Urgency. It is recommended that the remedial measures listed in Section 7.2 be accomplished in the near future. The item recommended in paragraph 7.2a(1) should be pursued on a high-priority basis.

d. Necessity for Phase II. No Phase II inspection is required.

e. Seismic Stability. Sweetwater Dam is in Seismic Zone 2, for which the recommended guidelines assign a "moderate" damage probability. The relatively low height and the type of material of which the dam was constructed minimize the likelihood of failure due to earthquake shock.

### 7.2 REMEDIAL MEASURES

a. Correction of Deficiencies.

(1) Repair scour hole and ditch which have been eroded downstream of the spillway at the right abutment, and take corrective measures to prevent reoccurrence of this problem.

(2) Increase the spillway size and/or dam height to pass one-half the Probable Maximum Flood without overtopping of the dam.

(3) Remove all trees and bushes growing on the embankments of the dam and in the left spillway approach channel and in both spillway exit channels. Removal of the stumps and roots of large trees should be done only under the direction and guidance of an engineer experienced in the design and construction of dams. Indiscriminate clearing could jeopardize the safety of the dam. Potential exists for other deficiencies such as rodent holes to be found after the trees and brush have been removed. Establish a grass or ground cover in those areas after the trees and brush have been removed and any rodent holes found have been filled.

(4) Permanently remove the fence that is presently located across the spillway at the left abutment.

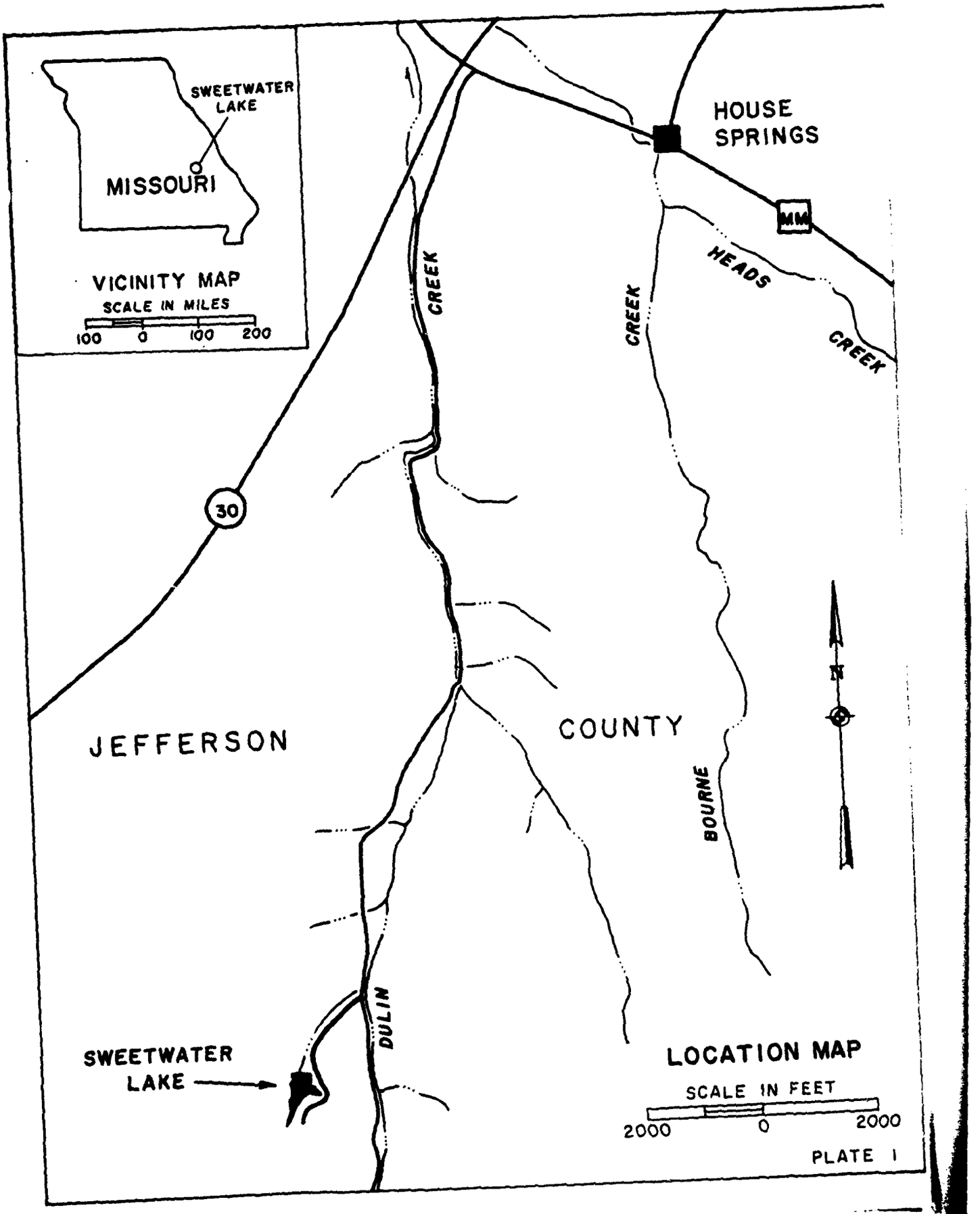
(5) Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

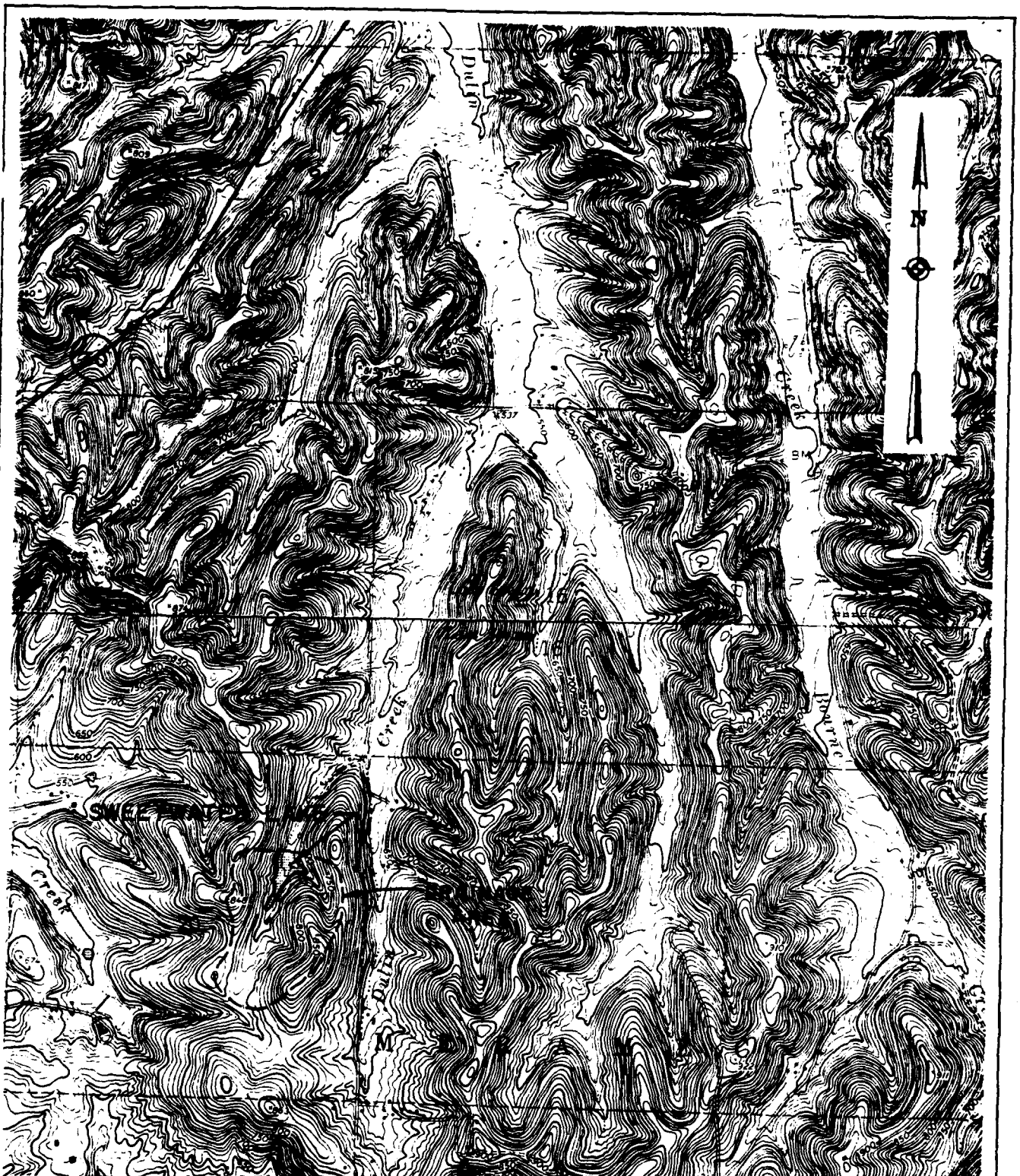
b. O&M Maintenance and Procedures.

(1) A grass or ground cover should be maintained on all areas of the dam embankment including the top of dam, embankment slopes, spillways and spillway exit channel areas. These areas shou d be mowed and maintained free of trees and brush growth.

(2) The areas to be kept clear of trees and brush described above should be inspected regularly to detect rodent holes, deterioration of turf, growth of trees and brush, erosion, settlements, etc., and prompt corrective actions should be taken if such conditions are found.

(3) The seepage in the left abutment spillway discussed in paragraph 3.1e should be monitored to detect the presence of soil materials in the flow or any increase in the quantity of flow. Any such changes in this seepage should be evaluated by an engineer experienced in the design and construction of dams.


SWEETWATER LAKE
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
HOUSE SPRINGS
MM
HEADS CREEK
CREEK
CREEK
30
JEFFERSON
COUNTY
BOURNE
DULIN
SWEETWATER LAKE
N
LOCATION MAP
SCALE IN FEET
2000 0 2000
PLATE 1




SCALE IN FEET

2000 1000 0 2000 4000

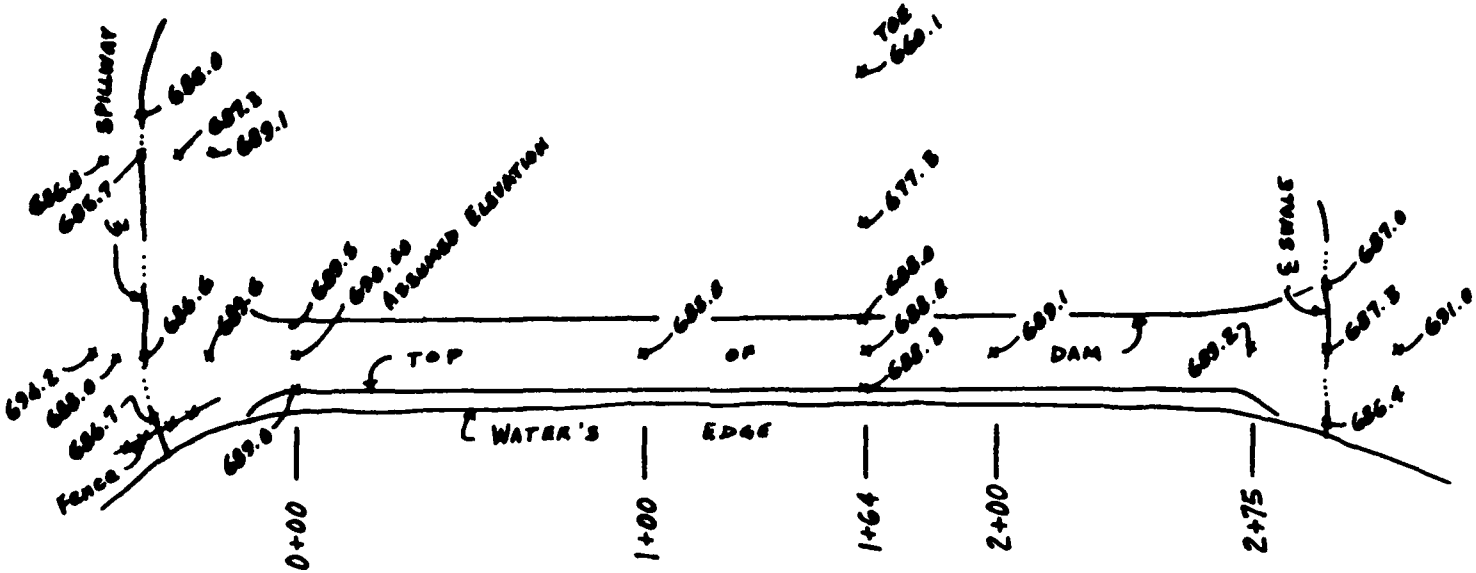
1000 500 0 1000

SCALE IN METERS

SWEETWATER LAKE

VICINITY TOPOGRAPHY

PLATE 2




WATER SURFACE ELEV. = 686.02

**SWEETWATER DAM**

**PLAN**

SCALE IN FEET

50 0 50

PLATE 3

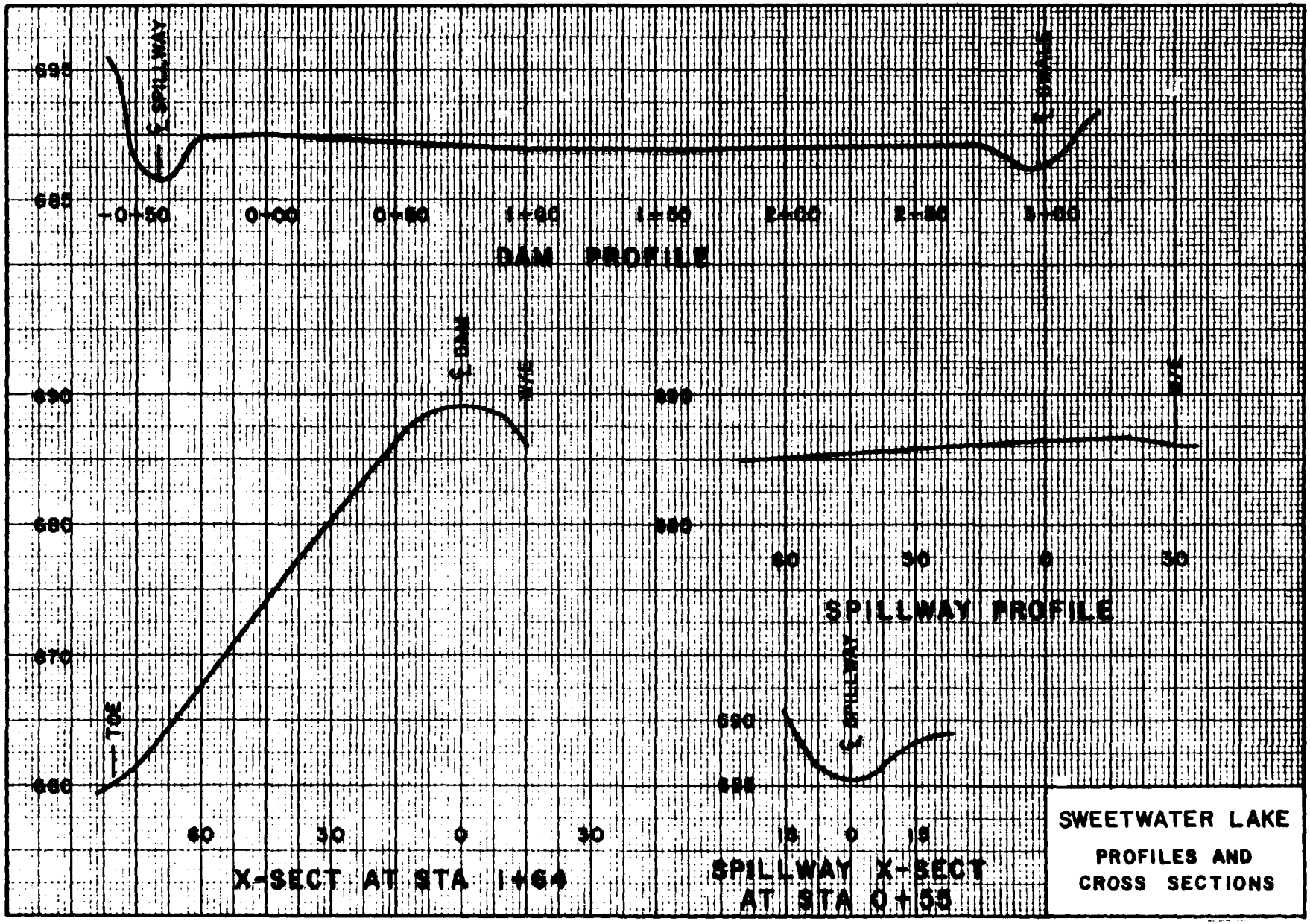

695
685
-0+50
0+00
0+50
1+00
1+50
2+00
2+50
3+00
DAM PROFILE
690
680
670
660
60
30
0
30
X-SECT AT STA 1+64
690
680
60
30
0
SPILLWAY PROFILE
690
680
15
0
15
SPILLWAY X-SECT
AT STA 0+55
SWEETWATER LAKE
PROFILES AND
CROSS SECTIONS

PLATE 4

# APPENDIX

# HYDROLOGIC COMPUTATIONS

## HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation for those dams in the high hazard potential category is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors have not been applied. A 24-hour storm duration is assumed with the 24-hour rainfall depths distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use, and antecedent moisture conditions according to the SCS hydrograph computation procedure.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the spillway, and crest of the dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The spillway capacity was determined as described in paragraph 3 below. The hydraulic capacity of the top of dam was calculated using the weir equation.

3. The left spillway rating curve was derived from the results of a normal depth rating curve at the spillway entrance. The right spillway rating curve was derived using the weir equation for a V-notch weir as defined in Kings Handbook of Hydraulics where $Q = CZH^{5/2}$. C = coefficient of discharge 2.5, Z = side slope of V-notch, H = depth of flow through spillway. The flow over the dam was calculated using the broad crested weir equation $Q = CLH^{3/2}$.

4. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

5. The above overtopping analysis has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed on PLATE A1. Definitions of these variables are contained in the "User's Manual" for the computer program. Additional printout is shown on PLATES A-2 through A-7.

DAM INSPECTION PROGRAM
SWEETWATER DAM INVENTORY NO. 30436 (SUMMARY SHEET)

HYDRAULIC AND HYDROLOGIC PARAMETERS

Drainage Area = 80 Acres

SCS Loss Rate Curve No. = 85 for antecedent moisture condition III

Time of Concentration: $T_c$ = 0.08 hrs. = 5 min. (using Kirpich eq.)

Lake Volume

| Elevation ft. msl | Storage ac-ft |
|---|---|
| 660 | 0 |
| 670 | 7.0 |
| 680 | 34.5 |
| 690 | 91.0 |
| 700 | 182.0 |

Combined Spillway and Dam Overtopping Rating Curve

| Elevation ft. msl | Storage ac-ft | |
|---|---|---|
| 687.0 | 0 | (Left spillway crest) |
| 687.5 | 7 | (Right spillway crest) |
| 688.0 | 21 | |
| 688.5 | 59 | |
| 689.0 | 135 | (Top of dam) |
| 690.0 | 864 | |
| 691.0 | 1877 | |
| 692.0 | 3806 | |

PLATE A-1

```
                1
                2
                3
                4
                5
                6
                7
                8
                9
               10
               11
               12
               13
               14
               15
               16
               17
               18
               19
               20
               21
               22
               23
               24
A1     NONAME 851 LAKE - MULTI-RATIO OF PMF FLOOD ANALYSIS
A2     FOR THE NATIONAL DAM INSPECTION PROGRAM.  INVENTORY NUMBER 30438.
A3     BY RON BIECKMANN - ST. LOUIS DISTRICT - DEC 78
B    288          0         5         0         0         0         0         0        -4         0
B1     5
J      1          8         1
J1    .1        .15        .2       .25        .3        .4        .5       1.0
K                 1                                      3
M      1          2      .125                          1                              1
P                 25       102       120       130
T                                                                 -1       -85
U2                .05
X                -.10       3.0
K      1          2                                      2         3         1
K1      ROUTE THROUGH LAKE
V                                                1                 1
V1     1                                                                  -686.0        -1
V4   687.0      687.5     688.0     688.5     689.0     690.0     691.0     692.0
V5     0          7        21        58       135       864      1877      3806
R5                7        34.5      91       182
RE     660       670       680       690       700
R8     657
R9     689
K      98

1                    PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                          RUNOFF HYDROGRAPH AT          1
                          ROUTE HYDROGRAPH TO           2
                          END OF NETWORK

E>
```

PLATE A-2

NONAME 251 LAKE - MULTI-RATIO OF PMF FLOOD ANALYSIS
FOR THE NATIONAL DAM INSPECTION PROGRAM. INVENTORY NUMBER 30436.
BY RON DIECKMANN - ST. LOUIS DISTRICT - DEC 78

JOB SPECIFICATION

| NO | NMR | NMIN | IDAY | IHR | IMIN | METRC | IPLT | IPRT | NSTAN |
|---|---|---|---|---|---|---|---|---|---|
| 288 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | -4 | 0 |

| JOPER | MUT | LROPT | TRACE |
|---|---|---|---|
| 5 | 0 | 0 | 0 |

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 8 LRTIO= 1

RTIOS= .10 .15 .20 .25 .30 .40 .50 1.00

SUB-AREA RUNOFF COMPUTATION

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |

HYDROGRAPH DATA

| IHYDG | IUNG | TAREA | SNAP | TRSDA | TRSPC | RATIO | ISNOW | ISAME | LOCAL |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | .13 | 0.00 | .13 | 1.00 | 0.000 | 0 | 1 | 0 |

PRECIP DATA

| SPFE | PMS | R6 | R12 | R24 | R48 | R72 | R96 |
|---|---|---|---|---|---|---|---|
| 0.00 | 25.00 | 102.00 | 120.00 | 130.00 | 0.00 | 0.00 | 0.00 |

LOSS DATA

| LROPT | STRKR | DLTKR | RTIOL | ERAIN | STRKS | RTIOK | STRTL | CNSTL | ALSMX | RTIMP |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | -1.00 | -85.00 | 0.00 | 0.00 |

CURVE NO = -85.00 WETNESS = -1.00 EFFECT CN = 85.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .05

RECESSION DATA
STRTQ= 0.00 QRCSN= -.10 RTIOR= 3.00

TIME INCREMENT TOO LARGE--(NMQ IS GT LAG/2)

UNIT HYDROGRAPH 5 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .05 VOL= 1.00
647. 247. 57. 13. 3.

ENB-OF-PERIOD FLOW

| 0 MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP 0 | MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .01 | 0.00 | .01 | 0. | 1.01 | 12.05 | 145 | .21 | .20 | .01 | 147. |
| 1.01 | .10 | 2 | .01 | 0.00 | .01 | 0. | 1.01 | 12.10 | 146 | .21 | .20 | .01 | 183. |
| 1.01 | .15 | 3 | .01 | 0.00 | .01 | 0. | 1.01 | 12.15 | 147 | .21 | .20 | .01 | 188. |
| 1.01 | .20 | 4 | .01 | 0.00 | .01 | 0. | 1.01 | 12.20 | 148 | .21 | .20 | .01 | 184. |
| 1.01 | .25 | 5 | .01 | 0.00 | .01 | 0. | 1.01 | 12.25 | 149 | .21 | .20 | .01 | 186. |
| 1.01 | .30 | 6 | .01 | 0.00 | .01 | 0. | 1.01 | 12.30 | 150 | .21 | .20 | .01 | 186. |
| 1.01 | .35 | 7 | .01 | 0.00 | .01 | 0. | 1.01 | 12.35 | 151 | .21 | .20 | .01 | 186. |
| 1.01 | .40 | 8 | .01 | 0.00 | .01 | 0. | 1.01 | 12.40 | 152 | .21 | .20 | .01 | 187. |
| 1.01 | .45 | 9 | .01 | 0.00 | .01 | 0. | 1.01 | 12.45 | 153 | .21 | .20 | .01 | 187. |

PLATE A-3

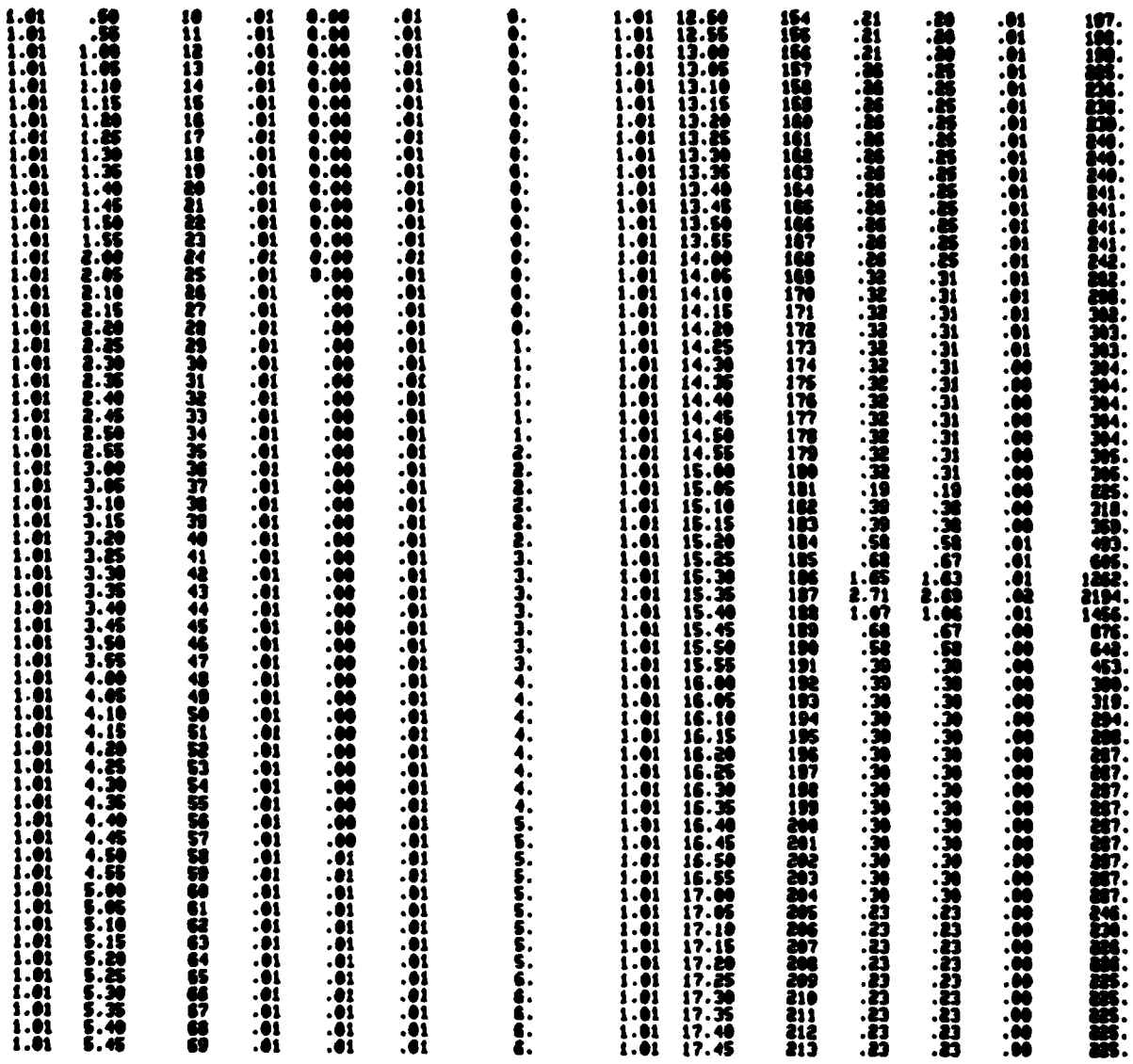


PLATE A-4

PLATE A-5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 10.50 | 130 | .00 | .00 | .01 | 55. | 1.01 | 22.50 | 274 | .00 | .00 | .00 | 00. |
| 1.01 | 10.58 | 131 | .00 | .00 | .01 | 55. | 1.01 | 22.58 | 275 | .00 | .00 | .00 | 00. |
| 1.01 | 11.00 | 132 | .00 | .00 | .01 | 55. | 1.01 | 23.00 | 276 | .00 | .00 | .00 | 00. |
| 1.01 | 11.08 | 133 | .00 | .00 | .01 | 56. | 1.01 | 23.08 | 277 | .00 | .00 | .00 | 00. |
| 1.01 | 11.10 | 134 | .00 | .00 | .00 | 56. | 1.01 | 23.10 | 278 | .00 | .00 | .00 | 00. |
| 1.01 | 11.15 | 135 | .00 | .00 | .00 | 56. | 1.01 | 23.15 | 279 | .00 | .00 | .00 | 00. |
| 1.01 | 11.20 | 136 | .00 | .00 | .00 | 56. | 1.01 | 23.20 | 280 | .00 | .00 | .00 | 00. |
| 1.01 | 11.25 | 137 | .00 | .00 | .00 | 56. | 1.01 | 23.25 | 281 | .00 | .00 | .00 | 00. |
| 1.01 | 11.30 | 138 | .00 | .00 | .00 | 56. | 1.01 | 23.30 | 282 | .00 | .00 | .00 | 00. |
| 1.01 | 11.35 | 139 | .00 | .00 | .00 | 56. | 1.01 | 23.35 | 283 | .00 | .00 | .00 | 00. |
| 1.01 | 11.40 | 140 | .00 | .00 | .00 | 56. | 1.01 | 23.40 | 284 | .00 | .00 | .00 | 00. |
| 1.01 | 11.45 | 141 | .00 | .00 | .00 | 56. | 1.01 | 23.45 | 285 | .00 | .00 | .00 | 00. |
| 1.01 | 11.50 | 142 | .00 | .00 | .00 | 56. | 1.01 | 23.50 | 286 | .00 | .00 | .00 | 00. |
| 1.01 | 11.55 | 143 | .00 | .00 | .00 | 56. | 1.01 | 23.55 | 287 | .00 | .00 | .00 | 00. |
| 1.01 | 12.00 | 144 | .00 | .00 | .00 | 56. | 1.02 | 0.00 | 288 | .00 | .00 | .00 | 00. |
| | | | | | | | | | SUM | 32.50 | 30.47 | 2.03 | 30666. |
| | | | | | | | | | | ( 826.)( 774.)( 51.)( 868.42) | | | |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 2104. | 338. | 186. | 186. | 30666. |
| CMS | 62. | 10. | 5. | 5. | 868. |
| INCHES | | .85.12 | 31.70 | 31.70 | 31.70 |
| MM | | 630.04 | 806.07 | 806.07 | 806.07 |
| AC-FT | | 167. | 211. | 211. | 211. |
| THOUS CU M | | 206. | 261. | 261. | 261. |

D

PLATE A-6

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

| OPERATION | STATION | AREA | PLAN | RATIOS APPLIED TO FLOWS RATIO 1 .10 | RATIO 2 .15 | RATIO 3 .20 | RATIO 4 .25 | RATIO 5 .30 | RATIO 6 .40 | RATIO 7 .50 | RATIO 8 1.00 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HYDROGRAPH AT | 1 | .13 | 1 | 219. | 329. | 439. | 549. | 658. | 878. | 1097. | 2194. |
| | ( | .38) | ( | 6.21)( | 9.32)( | 12.43)( | 15.53)( | 18.64)( | 24.86)( | 31.07)( | 62.14)( |
| ROUTED TO | 2 | .13 | 1 | 42. | 113. | 238. | 375. | 490. | 656. | 822. | 1594. |
| | ( | .38) | ( | 1.18)( | 3.20)( | 6.75)( | 10.62)( | 13.88)( | 18.58)( | 23.28)( | 45.15)( |

1 SUMMARY OF DAM SAFETY ANALYSIS

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 686.00 | 687.00 | 689.00 |
| STORAGE | 68. | 74. | 85. |
| OUTFLOW | 0. | 0. | 135. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|---|---|---|---|---|---|---|---|
| .10 | 688.27 | 0.00 | 81. | 42. | 0.00 | 16.00 | 0.00 |
| .15 | 688.85 | 0.00 | 85. | 113. | 0.00 | 15.83 | 0.00 |
| .20 | 689.14 | .14 | 86. | 238. | .33 | 15.67 | 0.00 |
| .25 | 689.33 | .33 | 87. | 375. | .42 | 15.67 | 0.00 |
| .30 | 689.47 | .47 | 88. | 490. | .50 | 15.67 | 0.00 |
| .40 | 689.71 | .71 | 89. | 656. | .83 | 15.67 | 0.00 |
| .50 | 689.94 | .94 | 91. | 822. | 2.67 | 15.67 | 0.00 |
| 1.00 | 690.72 | 1.72 | 98. | 1594. | 6.00 | 15.67 | 0.00 |

EOI.
D

PLATE A-7

PHOTO 1 TOP OF DAM (RIGHT SPILLWAY IN FOREGROUND. SCOUR HOLE BEGINS IN FRONT OF MAN AT RIGHT OF PHOTO.)

PHOTO 2 RIGHT SPILLWAY (Looking Upstream. Scour Hole Begins at Immediate Right Foreground)

PHOTO 3 RIGHT SPILLWAY EXIT CHANNEL (VIEW LOOKING UPSTREAM WITH SCOUR HOLE IN BACKGROUND)

PHOTO 4 LEFT SPILLWAY (LOOKING UPSTREAM)

PHOTO 5 LEFT SPILLWAY EXIT CHANNEL (LOOKING UPSTREAM)

PHOTO 6 DOWNSTREAM SLOPE OF DAM (LOOKING UPSTREAM)

PHOTO 7 LEFT SPILLWAY SEEPAGE